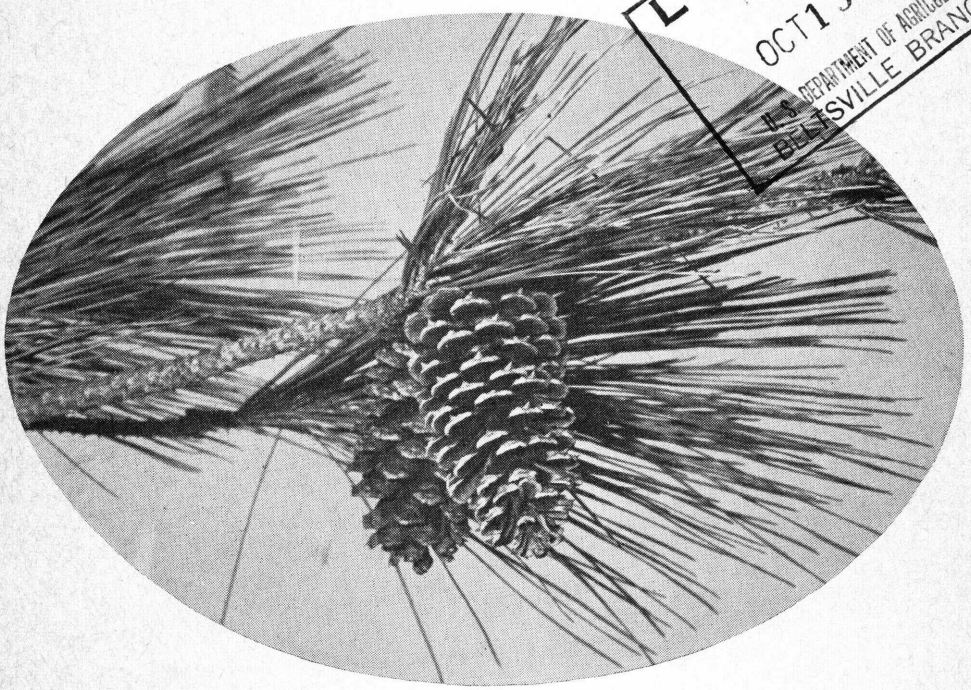
GROWING LOBLOLLY and SHORTLEAF PINE in the MID-SOUTH



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LOBLOLLY and shortleaf pines are rugged, thrifty trees whose wood is prized for many uses. These species respond easily and quickly to management.

Because even heavily cut stands can be rapidly brought back into production, this bulletin declares that "no situation is entirely hopeless." The first pages show the forest owner how to size up his woodland and diagnose its needs. Later pages give recommendations on protection against fire, control of unwanted trees, thinning and pruning, and harvesting and marketing timber. The information applies to loblolly and shortleaf pine lands in Arkansas, Oklahoma, Texas, Louisiana, Mississippi, Tennessee, and Alabama. Forest owners in more easterly localities should refer to Farmers' Bulletin 2097, *Growing Loblolly Pine in the South Atlantic States.*

But don't try to go it alone! Consult a forester about your problems. Your State forester or extension forester will be glad to advise you. Local foresters are usually available for on-the-ground assistance. If you don't know who the local foresters are, the county agent can tell you.

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Growing Loblolly and Shortleaf Pine In the Mid-South

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TIMBER MANAGEMENT—WHAT IS IT?

When an owner manages his timber, he is giving nature a helping hand. The entire object of management is to direct and control what takes place in the stand so that it will produce what the owner wants. This means growing the species that are in demand and that bring the best price. Furthermore, management aims at producing as much timber as possible per acre in as short a time as possible. To do this, the trees must be given enough space to develop fast-growing, clear boles—but no more. This good forestry practice is accomplished by proper thinning, by pruning where needed, by getting rid of undesirable trees that are merely taking up room, and by protecting the stand against fire and other damage. Finally, the timber crop must be harvested so as to insure the successful reseeding of the forest.

The prudent landowner will not "put all his eggs in one basket" by managing his forest so that only one product can be cut. By far the most profitable course is to grow a variety of items such as high-quality sawtimber, poles, piling, and pulpwood. This practice will not only assure the owner better returns but will also protect him against depressed or bad markets for any one product.

Why Grow Loblolly and Shortleaf Pine?

In the Mid-South, loblolly and shortleaf pine are usually found growing together, though pure stands of either are not uncommon. Both are fast-growing trees, and the lumber and timber they yield are always in demand. If wisely managed, a reasonably well-stocked stand under average growing conditions will produce 400–500 board-feet of sawtimber or 1.0–1.5 cords of pulpwood an acre a year. On very good soils, growth may be even faster than this.

Loblolly and shortleaf pine are in great demand because they serve a multitude of uses. Together, they make up 74 percent of the entire pine volume cut in the South. Their lumber goes into every form of interior and exterior construction. It is easily worked by hand and machine, takes nails well, and has other highly desirable qualities. Large trees, if they have dense wood, are suitable for the big timbers required in bridges and other heavy structures. Loblolly and shortleaf pine have the form and strength needed for poles and piling of all sizes and qualities. When treated with a suitable preservative, they make durable fence posts. Vast quantities of loblolly and shortleaf pine are manufactured each year into pulp and paper.

Ready markets for pine logs and bolts exist almost everywhere in the South. From one to a dozen or more sawmills can be found in nearly every county or parish. Pulpmills are less numerous, but pulpwood buyers and producers are located in most timbered areas. Railroads buy ties, and large numbers of treating plants furnish markets for fence posts, poles, piling, and heavy timbers.

Many fields, too poor to farm, and upland timber areas, overgrown with undesirable kinds of hardwoods, now

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lie idle. On most or all of this land loblolly and shortleaf pine can be grown profitably.

Make the Most of What You Have

Many landowners whose stands have been heavily cut over mistakenly conclude that nothing can be done except to "let nature take its course."

No situation is entirely hopeless. Most small woodlands fall into one of several common classes. These classes are described here, so that the owner can decide what his problems are, and what he can do to improve his property. It should be understood, of course, that before anything else is done the forest must be protected from fire (see p. 4).

Stands where all pine of pulpwood size and larger has been removed. In a stand of this kind, no seed will be produced for a long time, and the following points should be checked:

1. Is there young pine on the land? If there are as many as 700 or more well-distributed small pines per acre, and if they are not overtopped by weed hardwoods, then protection from fire and possibly from browsing or trampling by cattle is the only requirement in the early years.

2. Are the young pines overtopped by unwanted hardwoods? If so, the hardwoods must be eliminated. Recommendations for the control of cull hardwoods will be found on page 5.

3. Are the pine seedlings too few or too scattered? If so, the open spaces should be planted, and both the natural and planted pines should be released from any overtopping weed trees. Planting methods are discussed on page 7.

4. If no small pines are present, are there any cone-bearing pines on the sides of the cutover area? Border trees can generally be depended upon to seed an area 200 feet wide within a few years. Farther away than this, natural restocking requires too long and planting is the best solution.

Stands that have been heavily cut but that still have a few trees of pulpwood size or larger. If reseeding is required, the owner should determine whether the trees are big and numerous enough to do the job. For adequate restocking within 2 or 3 years, there should be at least 7 pines per acre, and they should be 12 inches in diameter or larger. With fewer or smaller seed trees, planting is recommended.

Stands still having some pines of merchantable size. Much can be done to improve these stands. As little as 2,000 or 3,000 board-feet per acre—the equivalent of 20 to 30 twelve-inch trees per acre—provides an excellent start. In such stands, the first step usually is to deaden or sell the undesirable hardwoods, and market any pine trees that are diseased, bug-infested, very limby, or crooked. Where the pines occur in crowded groups, they should be thinned (p. 12). If some of the younger trees are limby, pruning will pay off (p. 14).

TREE CHARACTERISTICS

Loblolly Pine

Loblolly pine is capable of growing rapidly to very large sizes. Some of the largest individual pines ever found in the South have been loblolly.

The needles vary from 4 to 9 inches in length and are usually found three to a cluster (fig. 1). The cone is very prickly and is from 3 to 5 inches long. The bark is dark brown and rough. On young or fast-growing trees it is deeply ridged. On old, mature trees the ridges are flat and broad.

On the whole, loblolly pine reproduces itself well, and, once established, will grow vigorously if given sufficient room. In young stands, height growth of 2 to 3 feet per year is common. On land of average quality in the Mid-South, loblolly will grow 75

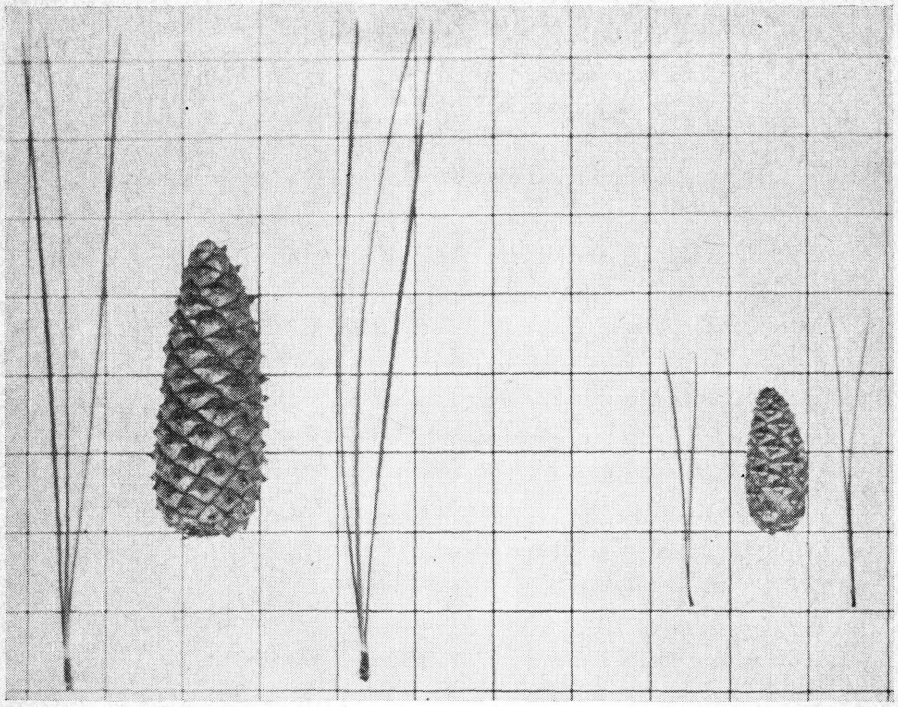

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Figure 1.—Left, **Loblolly pine cone and needles;** *right,* **shortleaf pine cone and needles. The background is divided into one-inch squares.**

to 85 feet in height in 50 years. On excellent timberland it will attain heights of 110 feet in the same period. Loblolly prefers the better and wetter sites and sometimes is found on the edges of swampy areas. In fact, the best and largest specimens grow in such locations. Loblolly, as well as shortleaf, is most susceptible to severe damage by wildfires during the first 15 years of its life.

Shortleaf Pine

Shortleaf pine needles average 3½ inches in length and are usually found 2 to the cluster. The cones are about 2 inches long and have very fine prickles on the scales. Among the best identifying marks of shortleaf are the pitch pockets in the bark, which show up as small indentations surrounded by a round oily spot on the bark flake. Shortleaf is the only southern pine with this bark feature.

Shortleaf, like loblolly, reproduces itself very well. It has one unusual characteristic not found in any other of the major southern pines. When a young shortleaf is severely damaged, it will sprout and will thus survive where most other pines succumb.

On the average, shortleaf pine grows a little slower than loblolly but not enough to warrant favoring one species over the other. Shortleaf has smaller limbs and generally prunes itself better than loblolly. It can grow on the poorer sites and where the terrain is steep and the soil shallow, as in the mountains. In these places it is usually found in pure stands because loblolly cannot thrive under such harsh conditions. Shortleaf will grow on tight, wet soils, and loblolly often does

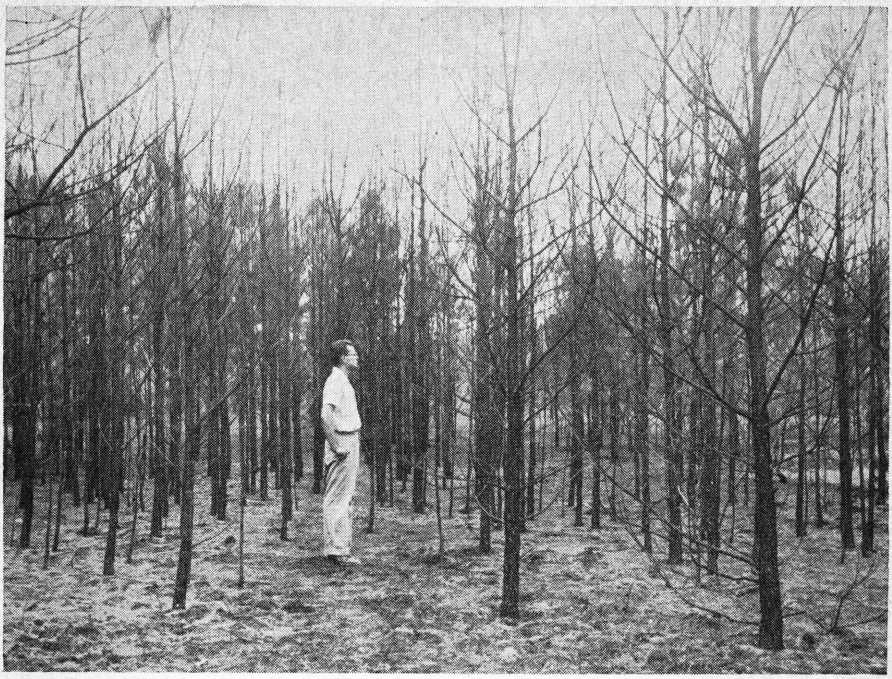

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Figure **2.—Fire has completely destroyed this stand, causing great loss to the owner. Protection from fire is the first essential of timber management.**

extremely well on them. Both, however, do best on well-aerated sandy clay and sandy clay loams with plenty of moisture during the growing season. Neither species will grow as well on badly eroded sites as on areas with good topsoil, but their value in preventing erosion is great.

PROTECTION

Timber stands cannot be successfully managed unless they are protected against wildfire, insects, disease, and browsing by livestock. Wildfire is by far the most feared enemy of the forest because it strikes suddenly and unexpectedly and can in a few minutes completely destroy timber that requires many years to grow (fig. 2).

Fire protection measures are easy to apply. In localities where fires are frequent, a 6-foot or wider fireline around a woodland may be good insurance. A fireline must be replowed or reworked each year to keep it from growing over. Pasture strips 50 feet wide make satisfactory firebreaks if kept closely grazed. They are especially useful on land where a bare firebreak might start to erode.

Each year much damage is done by fires that escape from farmers who are burning weeds or brush. If a field or brush patch is to be burned, plow or rake a line around it. Do not burn during dry spells or when the wind is high. Do not leave fires unattended. If you need guidance on when and how to burn, request the advice from the State forestry department. Before you burn, *notify the nearest fire warden,* so that he will not waste time and effort on false alarms. When you see any wildfire, whether in the woods or not, report it promptly.

Pines are attacked by a variety of insects and diseases. Some of these

are serious and some are not, but the identification of insects and diseases is a task for an expert. A forest owner who suspects that his stands may be under attack should report the matter to his State forester, extension forester, or county agent, who will put him in touch with someone who can diagnose the trouble and suggest what action should be taken.

Cattle sometimes browse or trample pine seedlings. If possible, they should be excluded from plantations or reseeded areas until the pines are 6–8 feet tall. Where exclusion is impracticable, grazing should be very carefully watched and controlled.

CULL HARDWOOD CONTROL

One of the most profitable and quickest treatments that can be given a pine area is to release young pines from the competition of low-grade hardwoods (fig. 3.) Such hardwoods occupy much growing space although producing very few if any dollar returns. They also deprive pine seedlings of moisture and retard their growth to such an extent that few survive. If pine areas bearing poor-quality hardwoods are to continue growing pine or are to be planted to pine where no pine is present, some hardwood control is necessary.

Complete eradication of hardwoods is rarely practicable or desirable. Where squirrel and deer hunting is a primary consideration of the owner, less deadening of oak and hickory culls is advocated than where timber growing is a primary consideration. There is usually a happy medium that will favor timber trees while at the same time leaving adequate game food.

Four general methods of killing unwanted hardwoods that cannot be sold are now in use: (1) Chopping a notch-girdle or a single-hack frill around the tree, (2) chemical treatment, (3) brush cutters, and (4) prescribed burning. Each is suited to different hardwood conditions. Sometimes a combination of treatments is best.

In the loblolly-shortleaf pine belt in the Mid-South, the most common hardwood situations fall into five broad classes. They are listed below with suggested remedies for each.

Large pine seedlings (over 2 feet high) are overtopped by hardwoods of various sizes.—Girdle hardwoods 4 inches in diameter and larger, and cut any smaller ones that are competing with the pines. The pines are large enough to keep ahead of any sprouts that may develop.

Small pine seedlings are dominated by poor hardwoods under 12 inches in diameter at breast height.—Frill hardwoods 3 inches in diameter or larger and pour in a water mixture of some sprout-inhibiting chemical,[2] such as Ammate or low-volatile esters of 2,4,5-T or 2,4-D (fig. 4). Or, put Ammate crystals in notches chopped in the base of the hardwoods. Smaller hardwoods should be cut close to the ground and the top and sides of the stump wet with an oil solution of 2,4,5-T or 2,4-D. Here sprout control is important, for pine seedlings cannot compete with the great number of fast-growing sprouts that small hardwoods send up when they are girdled but not chemically treated.

Pine seedlings and seed trees are lacking and the land is occupied by poor hardwoods under 12 inches in diameter.—Plant pine seedlings under the hardwoods. Within one year after planting, girdle all hardwoods over 12 inches in diameter and use sprout-inhibiting chemicals on the smaller ones.

Small pines are growing under scattered, large, unmerchantable hardwoods.—Girdle the hardwoods. Most hardwoods over 12 inches in diameter sprout very little and often not at all.

[2] Use of all chemicals mentioned in this bulletin should accord with the directions and warnings on the label.

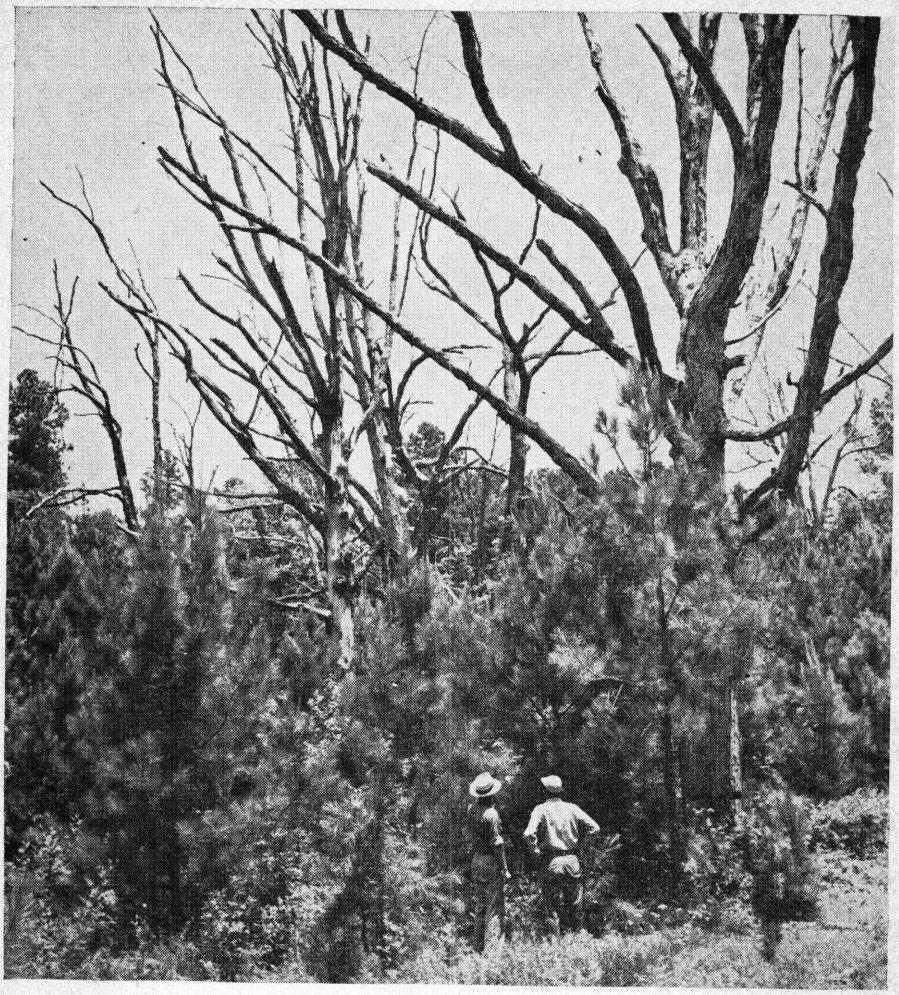

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Figure 3.—Pines grow vigorously when released from overtopping cull hardwoods.

Pine seed trees are either absent or present but small hardwoods, vines, and brush (mostly an inch or less in diameter) are so thick that the establishment of pine reproduction is impossible.—The area can be temporarily cleared with a mechanical brush cutter or by burning under carefully prescribed conditions. If enough pine seed trees are present, defer the brush control work until just before a good seed year. If no seed trees are present, planting must be done as soon after the hardwood control treatments as possible.

Whenever control of sprouts is important, hardwoods should be treated in the spring about the time they reach full leaf. If only crown kill is needed, chemicals can be used at any season, but girdling is most effective in the spring.

Costs vary with the size and number of the hardwoods to be treated. On

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Figure 4.—**This cull hardwood has been encircled with a single-hack frill into which a water mixture of a tree-killing chemical is being poured. The chemical hastens the death of the tree and minimizes sprouting.**

a test area averaging 190 five-inch hardwoods per acre, girdling and various chemical treatments cost between $4.20 and $5.20 per acre. Labor accounted for over 90 percent of the cost of all treatments. If the landowner does the work himself, the expense for equipment and materials amounts to very little. An acre can be treated in about half a man-day of work.

New methods and chemicals for controlling hardwood are being constantly developed. For detailed information on the best methods, request literature from your State forester, the U. S. Forest Service, the Soil Conservation Service, or your county agent.

PLANTING

Where natural pine seedlings are lacking or impossible to establish within a reasonable time, planting becomes necessary.

As a general rule, seedlings are obtained from State nurseries, which sell them at cost. Prices vary somewhat from year to year and in different places but have averaged from $2.50 to $3.50 per thousand f. o. b. the nurseries in the Mid-South. In some places lumber and paper companies distribute seedlings free, in limited quantities, to small landowners. Such free distribution is sometmes made through county agents and local Soil Conservation Districts. Some concerns will match free a quantity of seedlings equal to that purchased by the landowner. Cost-sharing under the Agricultural Conservation Program provides financial aid for the landowner who plants his land to trees. Under this program the Government pays a share of the planting costs, provided that the planting is done under certain specified conditions. The State forester, county agent, and the Soil Conservation District have information relating to planting assistance and availability of planting stock.

Planting is usually done in winter or early spring, but orders for stock should be placed well in advance.

The spacing most generally used for pine seedlings is 6 feet by 6 feet. This spacing figures out to 1,210 seedlings per acre, but in practice the number of trees actually planted per acre is about 1,000.

Choice of Species

Loblolly and shortleaf pine may be planted either in mixture or in pure stands. Shortleaf is better suited to the steeper, drier slopes than loblolly. Loblolly should be planted in areas where littleleaf disease is prevalent, because this species is far more resistant than shortleaf pine to this disease. On most other sites the owner may suit his own preference or consult a forester if in doubt. Generally, only one species is used on a given area or site, but mixed plantations are less subject to complete loss by disease or insects.

Heeling-In

Loblolly and shortleaf pine planting stock is usually bare-rooted, one-year old, nursery-grown seedlings. Such stock should be planted as soon as possible after being received from the nursery. Between the time of receipt and the day of planting the seedlings should be stored by heeling-in.

For a heel-in bed pick a level or slightly sloping area, preferably well drained, and clear it of roots and grass. Dig a trench 2 to 4 inches deeper than the length of the seedling roots; one side should be smooth and sloping, so that the seedlings can be laid on it.

Seedlings usually come in bundles of 50 or 100. Place these in the trench, packed closely together, in a layer one bundle deep, so that the roots lie flat against the sloping side of the trench and the tops of the seedlings are above ground level. If the seedlings are loose, they should be placed in a layer no more than 2 or 3 inches deep. Roots should be laid straight, with the root collars 1 to 2 inches below the surface of the undisturbed soil. Loblolly and shortleaf pine seedlings show a distinct root-collar line, for they are dull green above the ground level and yellow-brown below.

Fill the trench with earth to a level of 1 to 2 inches above the root collars, and pack the earth against the roots. Water the soil in the trench well. Be sure that all roots are covered and that the tops of the seedlings are free of earth. It is important to keep the roots from drying out. Planting stock can be left in the heel-in beds up to 3 or 4 weeks without any danger of injury, but the beds must be watered often enough to keep the soil continuously moist.

The best time to plant pine in the Mid-South is between December 1 and March 1, or when the danger of frost-heaving is over. Planting must be done before new growth starts in the spring. If prolonged fall drought has hardened the ground, planting should not be started until rain softens and moistens the soil.

Planting Details

Pines may be planted by using either handtools or a machine (fig. 5). Machines are expensive to buy and not always available for rental. Most owners of small tracts, especially if they want to plant only a few acres at a time, rely on hand planting.

The mattock is still used for planting, but today it has largely been replaced by planting bars (fig. 6). These can be purchased or made by a local blacksmith. To plant a tree, a slit is made by stepping on the bar to drive the blade into the ground. A backward movement of the bar handle widens the slit to permit easy insertion of the seedling roots. Next, the seedling is placed in the slit so that the roots are as straight as possible. Finally, the bar is thrust into the ground 3 or 4 inches behind the seedling and then moved back and forth to close the slit completely. Failure to close the top of the slit reduces seedling survival. If necessary, the planter can use his heel to close the top of the slit. Figure 7 shows bar planting in detail.

One of the most important points is to set the seedlings in the ground up to the root collar or just a bit deeper. Failure to plant seedlings at the correct depth accounts for more loss than all other types of planting errors combined.

The seedlings may be carried to the planting site in a pail or bucket with enough water, wet sawdust, or moss in it to keep the roots moist.

If the landowner does not wish to undertake the planting himself, it is possible to contract the job. Contract planting is being done by private individuals, and in some places the Soil Conservation Districts will provide contract services. Contract planting is done both by hand and machine.

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Figure 5.—**Six-year-old loblolly pine plantation. These trees average 12 feet in height.**

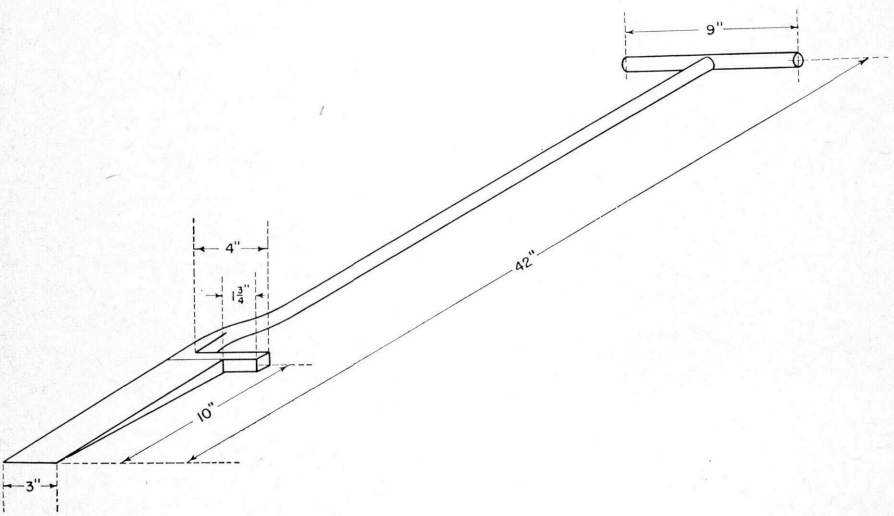

Figure 6.—**Planting bar.**

It is also possible to restock an area by sowing pine seed directly, either in spots or by broadcasting. However, this method is still uncertain, and for the present the safest course for the small landowner is to plant seedlings.

NATURAL REGENERATION

Natural seeding can generally be relied upon to restock cutover areas within 2 or 3 years if each acre has 7 or more well-distributed trees that are

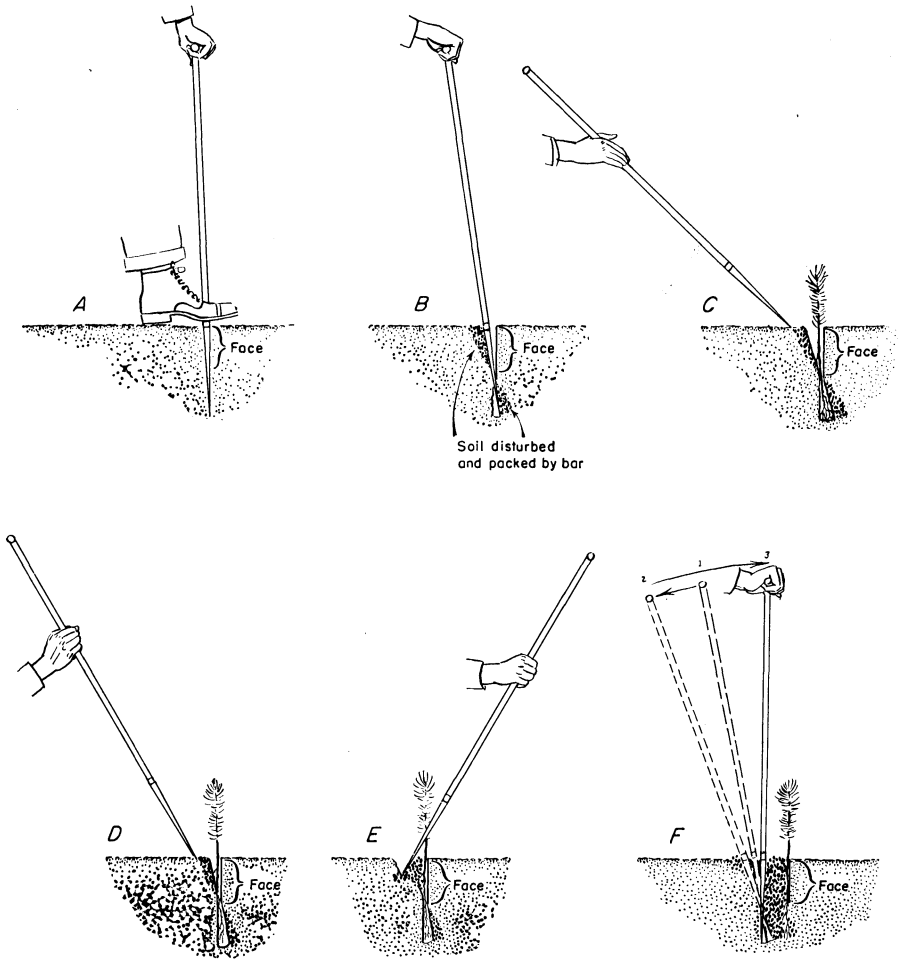

Figure 7.—**Steps in planting seedlings with a bar, when each man carries and sets his own trees. *A:* Start the planting slit by pushing the tool straight into the ground. *B:* Pull back on handle of bar to enlarge the slit. *C:* Withdraw the bar and insert the seedling with its root collar below the surface of the soil. *D:* Raise the seedling until the root collar is level with the soil surface. *E:* Close the top of the planting slit. *F:* Make a second slit to close the first slit completely; work the handle of the bar back and forth to pack the soil firmly against the roots of the seedling.**

either 12 inches in diameter or larger, or have borne cones in the past (fig. 8). Loblolly and shortleaf pine generally produce some seed every year, but good seed years occur irregularly—at intervals of 3 to 6 years or longer.

Seedfall usually begins about the middle of October, the bulk of the seed coming down in late October and early November.

In bumper seed years, an adequate catch of seedlings usually results regardless of seedbed condition. When the seed crop is light, seedbed preparation is necessary to use the supply to the fullest. For a given amount of

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Figure 8.—**Healthy loblolly and shortleaf pine reproduction occupies this area because enough seed trees were left when the stand was cut.**

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seed, a bigger catch of seedlings is obtained where the mineral soil is exposed than where the leaf litter is undisturbed.

Because logging exposes a great deal of mineral soil, a good seedbed is usually found in stands that have been heavily cut not more than a year before seedfall. Where no logging is planned, seed strips can be plowed, disked, or bulldozed through the forest, preferably in the late summer or early fall before seedfall begins.

A carefully prescribed fire will burn up the leaf litter and thus prepare a seedbed. Burning must be done before seedfall. Late summer or early fall burning is best in brushy areas. Burning is cheap, but it will destroy any young pines that may already be on the area. Any landowner considering the use of fire in his woods should first seek the advice of a forester.

Caution: Where soil erosion is a major problem, it is highly important that litter be disturbed as little as possible, even during logging.

The number of seedlings that live through the first year depends to a great extent on the weather. If prolonged drought follows germination, most if not all of the seedlings may die. On clear-cut areas it is desirable to have between 1,500 and 2,500 or more well-established seedlings per acre at the end of the first year. Natural losses will reduce this number, but if there are 700 or more well-established and fairly well-spaced seedlings per acre at the beginning of the third year, stocking can be considered satisfactory. In partially cut stands, seedlings are needed only in openings where pines have been cut or hardwoods deadened.

Before they are 2 years old, the pine seedlings should be freed from any overtopping undesirable hardwoods.

HOW TO MANAGE THE STAND

Thinning

Often pines grow in such crowded stands that the weaker trees die and become a total loss, while the stronger ones survive. This is Nature's thinning method—the survival of the fittest—but it is slow and very inefficient. Surplus trees should be thinned out, preferably as soon as they are big enough to be sold for pulpwood, fence posts, or some other product. Then other thinnings will follow every 3 to 5 years (fig. 9).

When to thin.—In natural stands the first thinning can be made when the trees are 15 to 20 years old. Planted stands will probably reach pulpwood size earlier, perhaps at 12 years.

The trees themselves are the best guide when thinning is needed (fig. 10). When the stand is so crowded that the length of the live crown is less than 40 percent of the total height of the tree, diameter growth is seriously reduced. For example, a tree 20 feet tall should have at least 8 feet of live crown. In very dense stands, crowns may become too short before the trees reach pulpwood size. Then surplus trees must be cut, even if they cannot be sold.

What trees to remove.—Thinning is essentially a matter of deciding which trees to cut or leave. The objective is to leave the best trees to produce a crop. Those that are so rough, limby, and crooked that they will produce only low-value logs should be removed as soon as possible (fig. 11). Diseased or bug-infested pines should be harvested before they die or infect other trees. Trees injured in logging or by storms or lightning should be removed before they die of the injury or suc-

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Figure 9.—Properly thinned stand of young pine. Because they have been given adequate space, these trees will grow rapidly. Thinning will be repeated as needed.

cumb to disease and insects. Trees suppressed or overtopped so much that recovery seems unlikely should also be taken out. In addition, enough otherwise good trees should be cut to relieve crowding and to promote rapid growth. Always leave the well-formed, cleanest, most vigorous individuals in the stand for crop trees.

Immediate removal of all the undesirable trees is not always possible. To avoid making large, unused openings, it may be necessary to keep some of these trees through one or two thinnings.

How much to thin.—Tree crown spacing is a good guide for determining how much to thin. The amount of space to be left between crowns depends largely on the rate at which the crowns spread and the length of time between thinnings. Loblolly and shortleaf pines that are to be thinned every 3 to 5 years may be spaced so that there is a distance of 3 to 4 feet between crown edges. If less frequent thinning is planned, the distance between crowns after thinning will have to be greater. In stands 15 years of age, the 3-foot crown spacing will leave 350 to 400 trees per acre, the number depending on the average crown size.

At the time of the first thinning it may be advisable to select for retention 100 to 150 crop trees per acre. These should be well-distributed, vigorous pines that will be kept in the stand through several future thinnings.

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Figure 10.—**Dense young pine stand in need of thinning.**

Pruning

Pines with straight, clean boles free of limbs and stubs produce high-quality lumber and bring a much better price than do rough, limby trees. Open-grown trees are usually very limby and must be pruned when small if they are ever to produce top-grade saw logs. Pines in close stands prune themselves naturally, but the process can be speeded up by artificial pruning. Artificial pruning should be limited to 100 to 150 crop trees per acre.

Trees should be first pruned when they are 3 to 5 inches in diameter. On good sites, trees of this diameter will be about 35 feet in height and may be pruned to one log (17 feet) and still have 40 percent or more of their total height in live crown. When trees are short, two or more prunings may be required to clean them to a height of 17 feet without reducing the live crown too much.

To insure rapid healing and to lessen the possibility of infection and rot, the pruning cut should be smooth and close to the trunk. Saws do a much better job than axes. A saw with a handle about 3 feet long permits easy pruning up to 8 or 9 feet on the bole.

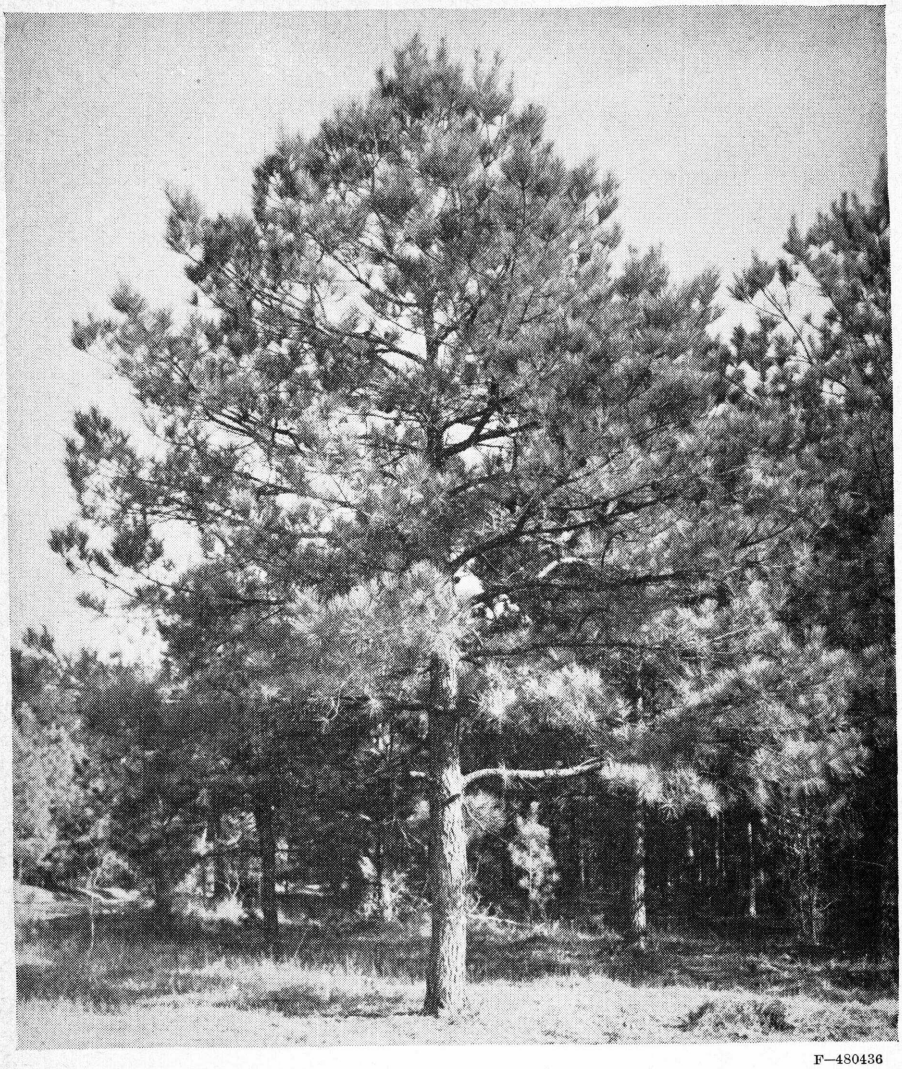

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Figure 11.—**Rough pines like this should be cut and sold.**

A pole saw with a magnesium or aluminum handle 12 feet or more in length is required for pruning to heights of 17 feet or over (fig. 12). The saw blade should be curved, rather narrow, and rigid. It should have 5 to 7 teeth to the inch, filed to cut on the down stroke. The head that attaches the blade to the handle should be adjustable to permit setting the blade at the most efficient cutting angle for each height.

To lessen the danger of insect attack, pruning is best done during the colder season. Pruning should not be done during prolonged drought or if there is evidence of bug infestations in the vicinity of the stand to be worked.

If the landowner does the work himself, the cash cost will be negligible.

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Figure 12.—**Pruning pine with a pole saw.**

About five loblolly or shortleaf pines can be pruned to a height of 17 feet in one man-hour. Pruning above 1½ logs (25 feet) necessitates the use of a ladder or an extra-long handle for the saw. Climbing and moving ladders is time-consuming and somewhat dangerous. Using very long saw handles is extremely fatiguing. For these reasons, pruning costs increase greatly when work is done above 25 feet.

Harvest Cutting

Loblolly and shortleaf pine, either in pure or mixed stands, can be successfully grown under even-aged or all-

aged management. In even-aged stands the trees are all about the same age—as in a plantation or a tract that seeded in at one time.

Although both even-aged and all-aged stands are thinned periodically, the big difference in handling them lies in the way the harvest cuttings are made. Until tests now under way are completed, no one can say whether even-aged or all-aged management will give the best growth, but current opinion is that 400–500 board-feet per acre annually can be grown in managed stands of either kind.

Following a series of thinnings, harvests in even-aged stands are made when the trees reach the size of the main product that the owner desires to market. Then all or most of the trees are cut in one operation. For example, if the owner wishes to grow chiefly pulpwood and small sawlogs, he will make the harvest cut at an early age, perhaps when the trees average 8-14 inches in diameter. If he wants to produce large, high-quality sawlogs, he might wait until his crop trees are 16 inches or larger in size.

In an even-aged stand, the harvest cutting should take all trees of pulpwood size or larger, except that about 7 to 12 well-distributed seed trees per acre (each 12 inches or more in diameter) should be left for seed (fig. 13). These seed trees should be cut when the seedlings they produce are big enough to be reasonably safe from fires of normal severity. This condition is usually reached when the new pines are about 15 years old, at which time they will be from 25 to 35 feet high. Then the seed trees can be cut and the new stand can be given its first thinning, all at the same time. Should the owner not wish to leave seed trees, he can plant.

In all-aged stands, trees of many ages and sizes are present at all times. As the larger trees reach maturity they are harvested. Consequently, harvest cuttings in all-aged stands are made frequently. Many owners find it convenient to cut every 5 years. In fact, a cutting may be made yearly if an annual income is desired.

At each harvest every tree is individually examined, and a decision made to cut it or leave it for additional growth. This method is sometimes called selective cutting (fig. 14). Under wise management, the bulk of each harvest will eventually come from large, high-quality trees. In addition, each cut will take out trees that are bug-infested, diseased, deformed, injured, or in need of thinning.

To build up heavily cut stands until they make full use of the growing capacity of the soil, the amount of timber harvested should be less than the growth. Table 1 is a rough guide to the amount to cut at 5-year intervals from stands on reasonably good sites. Thus in a lightly stocked stand of 3,000 board-feet per acre, 420 board-feet per acre can be harvested every 5 years. Because this rate of cutting is less than the growth, the volume per acre will increase and heavier cuts can be made in the future. When the tract reaches 6,000 board-feet per acre, the cut may be increased to 1,020 board-feet each 5 years.

To determine the amount of timber on his land, the owner will do well to seek advice from a forester. The owner will also profit from specific advice about the rate at which his trees are growing, the best harvesting intervals, and other matters.

WHAT TO EXPECT OF MANAGED STANDS

One way of showing what can be expected from timber growth and yields is to give actual figures from two small areas of mixed loblolly and shortleaf pine growing on a good site in southern Arkansas. Both woodlands were about 40 acres in size and were managed to produce a cut each year. Area 1 was reasonably well stocked when management began. Area 2

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Figure 13.—**Seed trees left after the harvest cut in an even-aged stand. About 12 good seed trees were left per acre to restock the area.**

had a light stand. Table 2 summarizes the volumes per acre and the total cut on the two tracts.

The important point brought out by table 2 is that with proper management it is possible to make repeated cuts and still increase the volume of timber in the stand (fig. 15). To accomplish this, only a part of the growth is harvested each year. When the volume per acre reaches a satisfactory level, the entire annual growth may be cut from that time onward.

If the variation in soil quality found

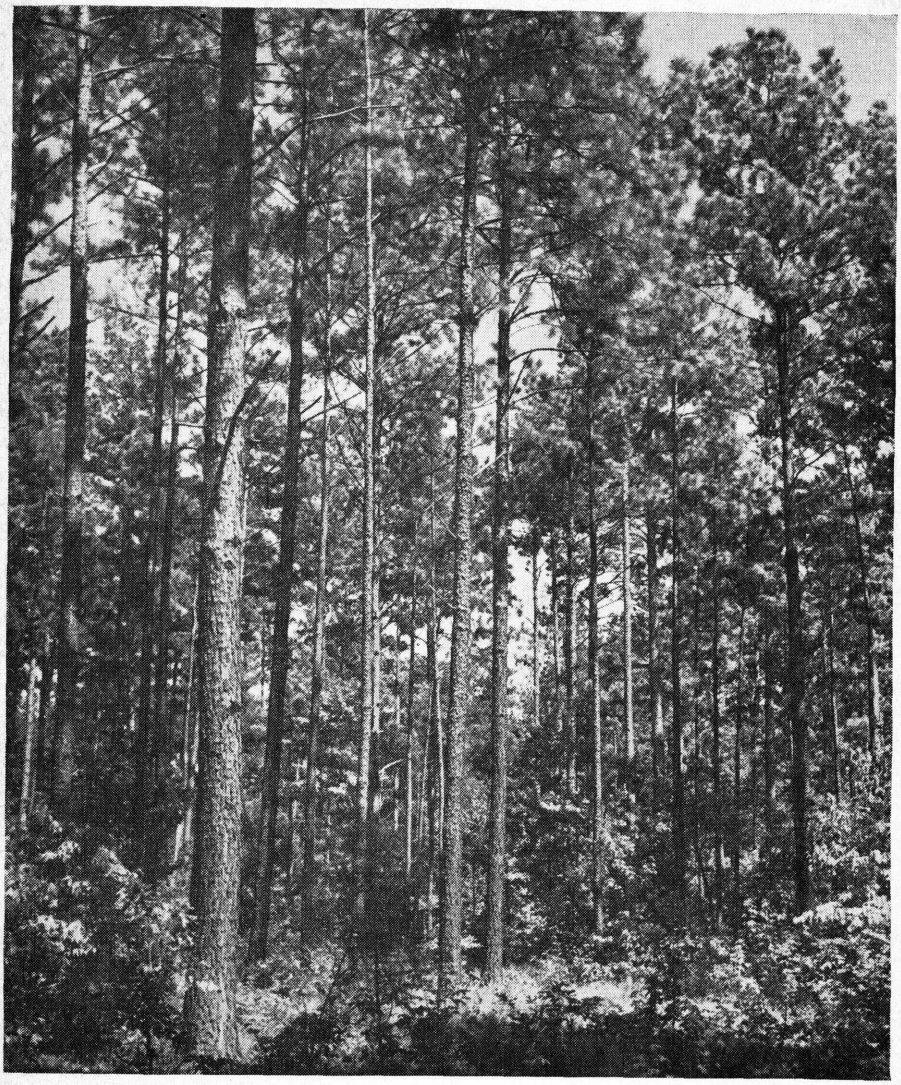

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Figure 14.—**An all-aged forest in which selective cutting is practiced. If managed properly, periodic cuts can be made in such a stand indefinitely.**

in the Mid-South is considered, it would seem that reasonably well-stocked stands, if carefully managed, should produce 400–500 board-feet of sawtimber or 1 to 1½ cords of pulpwood an acre a year. Under favorable conditions this rate of growth has often been exceeded.

What does it cost to manage a timber stand, and what returns can be expected? The information from the two areas may serve as a guide. Because the figures cover a 15-year period of both good and poor market conditions, they are conservative. However, the individual landowner must make allowances for his own particular situation.

TABLE 1.—*Suggested volume of sawtimber to cut every 5 years* [1]

Present stand volume per acre	Volume to be cut per acre	Present stand volume per acre	Volume to be cut per acre
Board-feet [2]	*Board-feet* [2]	*Board-feet* [2]	*Board-feet* [2]
10,000	2,500	5,000	800
9,000	2,070	4,000	600
8,000	1,680	3,000	420
7,000	1,330	2,000	260
6,000	1,020	1,000	120

[1] Reynolds, R. R., Bond, W. E., and Kirkland, B. P. *Financial aspects of selective cutting in the management of second-growth pine-hardwood forests west of the Mississippi River.* U. S. Dept. Agr. Tech. Bul. 861, 118 pp., illus. 1944.

[2] International log rule, ¼-inch kerf.

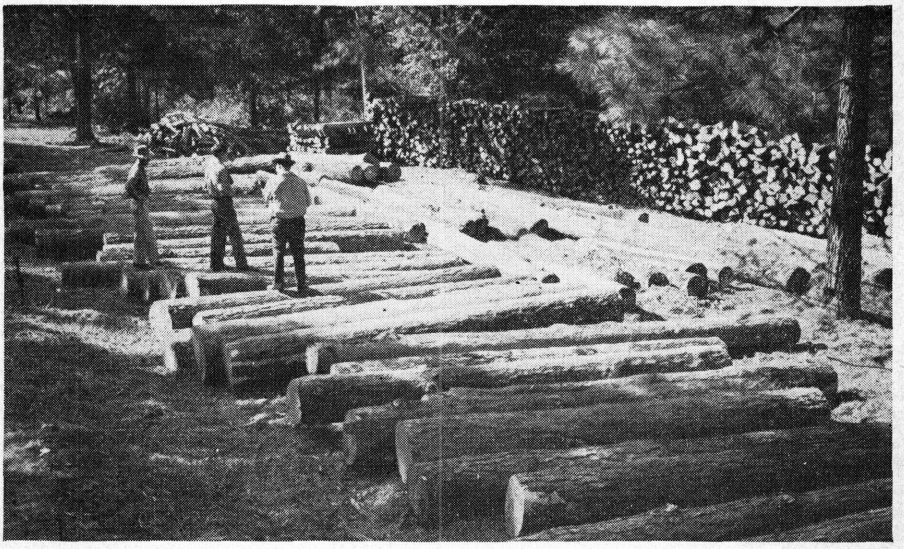

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***Figure 15.*—One year's harvest of logs and pulpwood from the 40-acre tract pictured in figure 14.**

The expense totaled 27 cents an acre a year. This amount covered taxes, fire protection, removal of undesirable hardwoods, timber marking, scaling (estimating the sound contents of a log), and supervision. In addition, the landowner contributed 1 hour of his time an acre a year.

The timber was sold as stumpage. Net returns an acre a year were:

	Area 1 moderately stocked	*Area 2 lightly stocked*
Stumpage value	$6.15	$3.78
Costs	.27	.27
Net returns	5.88	3.51

TABLE 2.—*Pine volume and total cut per acre in all-aged shortleaf and loblolly pine stands cut annually, 1937–51*

Period	Area 1 Moderately stocked		Area 2 Lightly stocked	
	Saw-log trees [1]	Pulpwood trees [2]	Saw-log trees [1]	Pulpwood trees [2]
	Board-feet	*Cords*	*Board-feet*	*Cords*
Volume per acre before cutting, 1937	5,978	6.5	2,757	3.9
Total cut per acre, 1937–51	5,140	7.8	1,990	4.5
Volume per acre, 1951	9,772	3.4	5,399	5.8

[1] Trees 12 inches and larger in diameter.
[2] Trees smaller than 12 inches in diameter.

If the landowner has a good market for delivered logs and pulpwood bolts, he can increase his yearly returns by doing his own logging. The owner of Areas 1 and 2 would have received 77 cents per man-hour for labor and the use of his equipment, if he had cut the products and delivered them to market. This amount would have been in addition to his stumpage returns. Area 1 would have provided about 14 man-hours of work per acre annually—a return of $10.78. On Area 2 almost 10 hours per acre were required to harvest the yearly crop, and the landowner would have earned $6.40. These figures are averages for the years 1937–51. In later years the returns for labor and equipment would be well over $1.10 per hour.

MARKETING THE CROP

Every landowner has a right to expect a fair price for the trees he sells. To improve his chances of making a fair bargain, he should take the following precautions:

1. Find out which products are in greatest demand and are bringing the best price, and then cut as much of the crop as possible into these products.

2. Mark all timber to be cut. If the owner is to do the cutting, one identifying mark such as an ax blaze or paint spot will suffice. Where the purchaser is to do the cutting, two marks should be made—one at breast height for the cutters to see and one below stump height to permit checking after cutting is done.

3. Estimate the volume and value of the timber to be cut. Tables 3 and 4, on pages 23 and 24, give the average number of board-feet and cords of unpeeled wood in loblolly and shortleaf pine trees of various sizes. Table 5, on page 25, shows the board-foot volume in logs. The State forester, Soil Conservation District officers, extension forester, or county agent can tell the farmer where to get help in estimating and marketing timber.

4. Obtain bids from as many prospective buyers as possible and be certain the purchaser is reliable and financially responsible.

5. Sell under written agreement. The best protection for the seller and

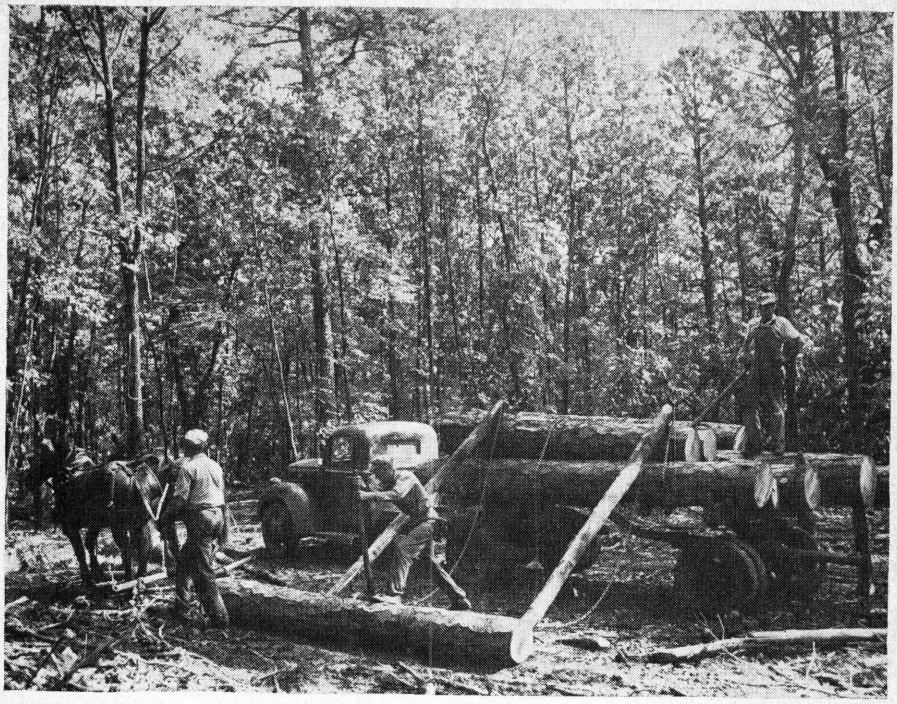

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Figure 16.—**When the landowner does his own logging, he increases the income from his woodlot considerably.**

buyer is to put the terms of the sale in writing.

6. Harvest the timber crop yourself if there is a good market for delivered products (fig. 16). Often the returns for cutting the timber and hauling it to market will equal from one-half to double the value of the stumpage alone. Accidents are costly and reduce profits. Do the harvesting safely.

7. Avoid overcutting.

VOLUME TABLES AND THEIR USE

The volume of a standing pine tree can be read from tables if the diameter and height of the tree are known. There are several very inexpensive and convenient scale sticks for measuring diameter and height. Any forester will know where such sticks can be purchased and can give pointers on their use. Tree diameter is always measured at breast height, 4½ feet above ground.

When diameter and height are known, board-foot volumes can be read from table 3. Suppose that a tree is 15 inches in diameter and 70 feet high. To find its board-foot volume, run down the left-hand column of table 3 to the number 15, and then move to the right, to the column for 70-foot trees. The volume is 197 board-feet.

The table assumes that the tree will be used to a top diameter of 5 inches inside the bark. Many log rules for measuring trees and logs are in use today. Tables 1, 2, 3, and 5 in this bulletin are based on the International

¼-inch rule, which gives values closely approaching the amount of lumber that can actually be cut from the tree.

Table 4, which gives volumes in standard cords of unpeeled wood, is used exactly as table 3. This table assumes that the tree will be used to a top diameter of 3 inches inside the bark. Thus a tree 9 inches in diameter and 50 feet high will contain about 0.11 cord. (A standard cord is a pile measuring 4 by 4 by 8 feet.)

Volumes in logs can be read from table 5 if the length and diameter of the log are known. Diameters are measured inside the bark at the small end. When the end is not circular but irregular in shape, the average diameter must be determined. If the log at the small end measures 16 inches one way and 14 inches the other, the average diameter will be 15 inches. A log 15 inches in diameter and 16 feet long contains 160 board-feet. The table gives the scale of logs that are straight and completely sound. If the log contains defects such as rot, crook, sweep, or shake, the volumes given in the table should be reduced accordingly.

TABLE 3.—*Average board-foot volume in loblolly and shortleaf pine trees of different total heights when utilized to a fixed top diameter of 5 inches inside bark, International ¼-inch log rule* [1]

Diameter breast high (inches)	Total height, feet							
	40	50	60	70	80	90	100	110
	Board-feet	*Board-feet*	*Board-feet*	*Board-feet*	*Board-feet*	*Board-feet*	*Board-feet*	*Board-feet*
6	12	14	15	18	.....	.....	.....	.....
7	14	17	21	26	.....	.....	.....	.....
8	17	24	32	41	52	.....	.....	.....
9	22	32	44	57	74	91	.....	.....
10	.....	43	59	76	98	119	.....	.....
11	.....	.....	76	98	124	149	.....	.....
12	.....	.....	95	121	150	179	.....	.....
13	.....	.....	117	145	179	212	.....	.....
14	.....	.....	138	171	209	247	.....	.....
15	.....	.....	159	197	240	285	330	.....
16	.....	.....	.....	223	274	325	376	.....
17	.....	.....	.....	251	309	368	425	.....
18	.....	.....	.....	280	347	414	478	.....
19	.....	.....	.....	310	386	462	535	.....
20	.....	.....	.....	346	429	511	590	666
21	.....	.....	.....	.....	473	564	652	737
22	.....	.....	.....	.....	520	621	718	809
23	.....	.....	.....	.....	573	683	787	884
24	.....	.....	.....	.....	624	743	856	961
25	.....	.....	.....	.....	673	803	928	1,044
26	.....	.....	.....	.....	722	866	1,001	1,128

[1] Derived from *Volume, Yield, and Stand Tables for Second-Growth Southern Pines.* U. S. Dept. Agr. Misc. Pub. 50, 202 pp. 1929. The averages of tables 5 and 21 were multiplied by 0.904762 to increase the kerf allowance from ⅛ to ¼ inch. (Misc. Pub. 50 is out of print but may be consulted in libraries.)

TABLE 4.—*Average rough cord volume in loblolly and shortleaf pine trees of different total heights when utilized to a fixed top diameter of 3 inches inside bark* [1]

Diameter breast high (inches)	Total height, feet							
	30	40	50	60	70	80	90	100
	Cords	*Cords*	*Cords*	*Cords*	*Cords*	*Cords*	*Cords*	*Cords*
4	0.0119	0.0168	0.0223	0.0266	.....	.....	.....	.....
5	.0194	.0273	.0347	.0416	0.0478	.....	.....	.....
6	.0278	.0386	.0498	.0598	.0685	0.0770	.....	.....
7	.0383	.0524	.0671	.0808	.0938	.1045	0.115	.....
8	.0492	.0682	.0874	.1055	.123	.139	.153	0.167
9	.0620	.0859	.110	.134	.155	.176	.196	.214
10	.0762	.1052	.135	.162	.190	.217	.241	.267
11	.....	.126	.162	.195	.230	.262	.292	.324
12	.....	.151	.192	.232	.274	.310	.348	.386
13	.....	.....	.226	.271	.320	.365	.411	.454
14	.....	.....	.260	.314	.371	.424	.476	.527
15	.....	.....	.298	.360	.426	.487	.549	.604
16	.....	.....	.337	.410	.482	.552	.624	.686
17	.....	.....	.....	.460	.541	.624	.704	.774
18	.....	.....	.....	.512	.603	.696	.788	.866
19	.....	.....	.....	.566	.668	.770	.875	.961
20	.....	.....	.....	.622	.736	.848	.963	1.062
21	.....	.....	.....	.....	.806	.927	1.057	1.16
22	.....	.....	.....	.....	.878	1.009	1.15	1.27
23	.....	.....	.....	.....	.951	1.090	1.24	1.38
24	.....	.....	.....	.....	1.024	1.18	1.34	1.49
25	.....	.....	.....	.....	1.10	1.26	1.44	1.60
26	.....	.....	.....	.....	1.18	1.36	1.54	1.72

[1] Average of tables 3 and 19 of *Volume, Yield, and Stand Tables for Second-Growth Southern Pines*. U. S. Dept. Agr. Misc. Pub. 50, 202 pp. 1929. (Out of print. Publication may be consulted in libraries.)

TABLE 5.—*Contents of logs in board-feet by the International ¼-inch log rule*

Diameter of log at small end inside bark (inches)	Contents when log length is—						
	8 feet	10 feet	12 feet	14 feet	16 feet	18 feet	20 feet
	Board-feet	*Board-feet*	*Board-feet*	*Board-feet*	*Board-feet*	*Board-feet*	*Board-feet*
6	10	10	15	15	20	25	25
7	10	15	20	25	30	35	40
8	15	20	25	35	40	45	50
9	20	30	35	45	50	60	70
10	30	35	45	55	65	75	85
11	35	45	55	70	80	95	105
12	45	55	70	85	95	110	125
13	55	70	85	100	115	135	150
14	65	80	100	115	135	155	175
15	75	95	115	135	160	180	205
16	85	110	130	155	180	205	235
17	95	125	150	180	205	235	265
18	110	140	170	200	230	265	300
19	125	155	190	225	260	300	335
20	135	175	210	250	290	330	370
21	155	195	235	280	320	365	410
22	170	215	260	305	355	405	455
23	185	235	285	335	390	445	495
24	205	255	310	370	425	485	545
25	220	280	340	400	460	525	590

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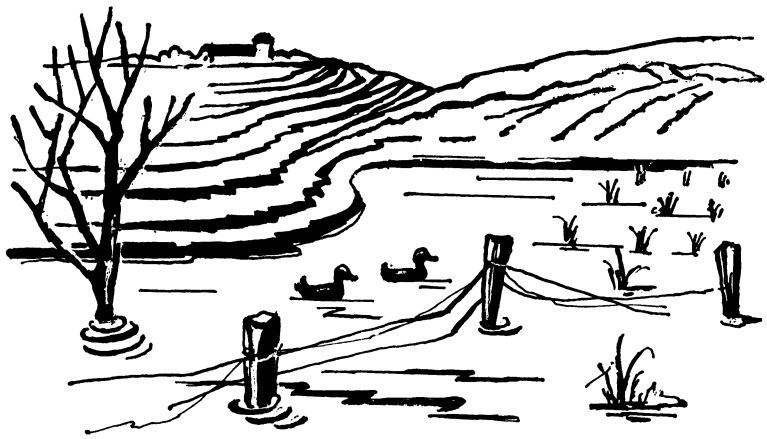

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